

Amendments to the Claims

1-35. (Cancelled)

36. (Currently amended) A method of forming a copper interconnection on a semiconductor device, said method comprising:

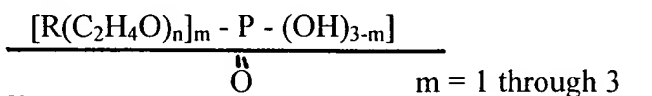
forming an auxiliary seed layer for reinforcing a copper seed layer in an interconnection groove defined in a surface of the semiconductor device using an electroless copper plating liquid containing i) ~~bivalent~~ copper ions, ii) a complexing agent, iii) an aldehyde acid, iv) an organic alkali, and v) an additive for stabilizing said electroless copper plating liquid and controlling a plating rate, said electroless copper plating liquid containing no endocrine disruptors; and

performing an electrolytic plating process using the seed layer including said auxiliary seed layer as a current feeding layer, for thereby filling copper in the interconnection groove defined in the surface of the semiconductor device,

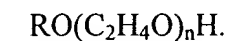
wherein said additive comprises at least one of polyoxyethylene alkylether phosphoric acid and polyoxyethylene alkylether,

wherein said polyoxyethylene alkylether phosphoric acid and/or polyoxyethylene alkylether has a structure indicated below:

(polyoxyethylene alkylether phosphoric acid)



(polyoxyethylene alkylether)



37. (Previously presented) A method according to claim 36, wherein said complexing agent does not contain alkali metals.

38. (Previously presented) A method according to claim 37, wherein said complexing agent comprises EDTA·4H (ethylenediaminetetraacetic acid).

39. (Previously presented) A method according to claim 38, wherein said EDTA·4H has a concentration ranging from 0.5 to 100 g/L.

40. (Cancelled)

41. (Currently amended) A method according to claim ~~40~~36, wherein said additive has a concentration ranging from 1 to 100 mg/L.

42. (Cancelled)

43. (Previously presented) A method according to claim 36, wherein said organic alkali does not contain alkali metals.

44. (Previously presented) A method according to claim 43, wherein said organic alkali comprises TMAH (tetramethylammonium hydroxide).

45. (Previously presented) A method according to claim 44, wherein the electroless copper plating liquid has a pH adjusted to a range from 10 to 14.

46. (Previously presented) A method according to claim 36, wherein said aldehyde acid comprises a glyoxylic acid.

47. (Previously presented) A method according to claim 46, wherein said glyoxylic acid has a concentration ranging from 1 through 50 g/L.

48. (Previously presented) A method according to claim 36, wherein said copper ions have a concentration ranging from 0.01 to 10.0 g/L.

49. (Currently amended) A method for forming copper interconnections within recesses in a surface of a semiconductor substrate, said method comprising:

providing a substrate with a copper seed layer within recesses in a surface of the semiconductor substrate;

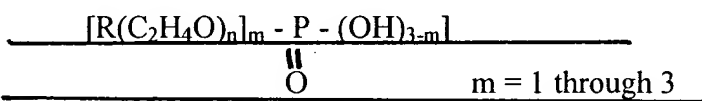
forming an auxiliary copper seed layer for reinforcing the copper seed layer within the recesses using an electroless copper plating liquid excluding endocrine disruptors at a plating rate of equal or less than 50 nm/min, said electroless copper plating liquid containing i) ~~bivalent~~ copper ions, ii) a complexing agent, iii) an aldehyde acid, iv) an organic alkali, and v) an additive for stabilizing said electroless copper plating liquid and controlling a plating rate, said additive containing no endocrine disruptors; and

filling copper in the recesses by an electrolytic plating process using the reinforced copper seed layer as a current feeding layer,

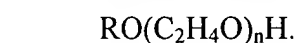
wherein said additive comprises at least one of polyoxyethylene alkylether phosphoric acid and polyoxyethylene alkylether,

wherein said polyoxyethylene alkylether phosphoric acid and/or polyoxyethylene alkylether has a structure indicated below:

(polyoxyethylene alkylether phosphoric acid)



(polyoxyethylene alkylether)



50. (Previously presented) A method according to claim 49, wherein at least one of the recesses has an inlet size of less than 0.18 μm .

51. (Previously presented) A method according to claim 49, wherein said complexing agent does not contain alkali metals.

52. (Previously presented) A method according to claim 51, wherein said complexing agent comprising EDTA·4H (ethylenediaminetetraacetic acid).

53. (Previously presented) A method according to claim 52, wherein said EDTA·4H has a concentration ranging from 0.5 to 100 g/L.

54. (Cancelled)

55. (Currently amended) A method according to claim ~~54~~49, wherein said additive has a concentration ranging from 1 to 100 mg/L.

56. (Cancelled)

57. (Previously presented) A method according to claim 49, wherein said organic alkali does not contain alkali metals.

58. (Previously presented) A method according to claim 57, wherein said organic alkali comprises TMAH (tetramethylammonium hydroxide).

59. (Previously presented) A method according to claim 58, wherein the electroless copper plating liquid has a pH adjusted to a range from 10 to 14.

60. (Previously presented) A method according to claim 49, wherein said aldehyde acid comprises a glyoxylic acid.

61. (Previously presented) A method according to claim 60, wherein said glyoxylic acid has a concentration ranging from 1 through 50 g/L.

62. (Previously presented) A method according to claim 49, wherein said copper ions have a concentration ranging from 0.01 to 10.0 g/L.